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SCIENTIFIC CONFERENCES AND ACTIVITIES IN THE USSR

- USSR -

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## FOREWORD

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## SCIENTIFIC CONFERENCES AND ACTIVITIES IN THE USSR

- USSR -

[This report contains the translations of eight articles concerning scientific conferences in the USSR, which were published in various Soviet publications. Complete bibliographic information accompanies each article.]

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## A SYMPOSIUM ON CERTAIN PROBLEMS OF MATHEMATICS AND MECHANICS

Following is the translation of an article by A.K. Chernenko in Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR (Herald of the Siberian Branch of the USSR Academy of Sciences), No 1, Novosibirsk, 1961, pages 123-124.

A symposium on certain problems of mathematics and mechanics was held on 17 through 19 November, 1960, in the Akademgorodka ("Academy City") district of Novosibirsk. It was attended by some of the leading Soviet scientists.

The reports included in the conference agenda were grouped mainly in three main categories of mathematics and mechanics each of which was aided in its development by some significant contribution of Academician M.A. Lavrent'yev, who celebrated his sixtieth birthday and fortieth anniversary of scientific, pedagogical, and social activity on 19 November, 1960.

The symposium opened with a paper by Academician M.A. Lavrent'yev entitled "Certain Problems in the Motion of Liquids With Unrestricted Surfaces".

A survey report on studies of stability carried out at the Academy of Sciences of the Ukrainian SSR under the direction of M.A. Lavrent'yev was presented by Academician A.Yu. Ishlinskiy (Moscow State University).

Academician A.A. Dorodnitsyn (Computing Center of the USSR Academy of Sciences) presented a paper entitled "Methods of Solving Boundary Layer Equations".

Doctor of Technical Sciences G.S. Migirenko (Hydrodynamics Institute of the Siberian Branch) spoke on certain problems of destruction dynamics; Doctor of Physico-Mathematical Sciences N.N. Moiseyev presented a paper on the results of studies of nonlinear waves in continuous media carried out at the Computing Center of the USSR Academy of Sciences.

The vapor-gas cycle and certain problems in power production connected with it were discussed by Academician S.A. Khristianovich (Institute of Theoretical and Applied



Mechanics of the Siberian Branch).

Academician L.I. Sedov (Mechanics Institute of Moscow State University) presented a paper entitled "On the Basic Concepts of Continuous Media Mechanics".

Academician P.Ya. Kochina (Hydrodynamics Institute of the Siberian Branch) spoke on the application of complex variable theory to the problems of filtration.

Academician S.L. Sobolev (Mathematics Institute of the Siberian Branch) reported on studies of volume formulas.

Academician I.N. Vekua (Novosibirsk State University) dealt in his paper with generalized analytic functions and quasiconformal mapping.

Corresponding Member of the USSR Academy of Sciences A.V. Bitsadze (Mathematics Institute of the Siberian Branch) reported on several problems involved in the theory of mixed compound equations.

A joint paper by Doctors of Physico-Mathematical Sciences L.D. Kudryavtsev and S.M. Nikol'skiy (Mathematics Institute imeni V.A. Steklov of the USSR Academy of Sciences) dealt with envelope theorems and their application to the solution of elliptic equations.

Doctor of Physico-Mathematical Sciences L.I. Volkovyskiy (Perm' State University) presented a paper on the subject of singular integral equations and potential theory on Riemannian surfaces.

Academician A.I. Mal'tsev (Mathematics Institute of the Siberian Branch) spoke on algebraic constructiveness.

Corresponding Member of the USSR Academy of Sciences A.D. Aleksandrov (Leningrad State University) presented a paper on the Maximum Principle.

Several new results in constructive function theory were described in the paper of Corresponding Member of the USSR Academy of Sciences and Academician of the Academy of Sciences of the Armenian SSR S.N. Mergelyan, (Computing Center of the Armenian SSR Academy of Sciences).

The reports were followed by lively discussions.

Corresponding Member of the USSR Academy of Sciences L.A. Galin (Mechanics Institute of the USSR Academy of Sciences) centered his remarks on the boundary problems of elasticity theory in cases of variable elasticity moduli.

Candidate of Physico-Mathematical Sciences K.Ye. Gubkin (Chemical Physics Institute of the USSR Academy of Sciences) presented a brief report entitled "Weak Shock Wave Defraction at Small Angles".

Candidate of Physico-Mathematical Sciences S.K. Godunov spoke on certain paradoxes of quasilinear equations; Candidate of Physico-Mathematical Sciences Yu.G. Reshetnyak dealt with quasiconformal mappings in space.



Doctor of Physico-Mathematical Sciences S.G. Kreyn (Voronezh State University) developed a number of points on interpolation theorems in operator theory.

Doctor of Physico-Mathematical Sciences A.A. Nikol'skiy (Mechanics Institute of the USSR Academy of Sciences) spoke on the motion of bodies in a rotating fluid.

Solutions of axially symmetrical problems in elasticity theory with the aid of analytic functions were described by Doctor of Technical Sciences A.Ya. Aleksandrov (Novosibirsk Railway Transportation Engineering Institute).

Doctor of Physico-Mathematical Sciences P.F. Fil'chakov (Mathematics Institute of the Ukrainian SSR Academy of Sciences) described methods of solving forced filtration problems with the aid of ruler and compass.

Yu.L. Rodin (Perm' State University) examined the Riemann boundary problem and its application.

The report presented at the symposium will be published in a separate volume.



## CONFERENCE ON PROBLEMS OF GEOBOTANICAL CARTOGRAPHY

Following is the translation of an article by Ye.I. Lapshina in Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR (Herald of the Siberian Branch of the USSR Academy of Sciences). No 1. Novosibirsk, 1961, pages 124-126.

The first All-Union Conference on the problems of geobotanical cartography, held under the auspices of the Siberian Branch and the Biological Sciences Section of the USSR Academy of Sciences, was held from 14 through 18 November in Novosibirsk.

The Conference was attended by over 150 persons representing institutes of the USSR Academy of Sciences, institutes of the republican academies, and about 40 non-academic institutions located in various cities.

In his introductory address, Academician A.A. Trofimuk noted the great importance of vegetation maps in evaluating the natural conditions in newly-developed territories as well as in promoting the intense integration of our country's natural resources into the economic life of the nation.

The Conference participants heard and discussed over 50 papers on vegetation cartography. The reports were broken down into thematic cycles, each of which was dealt with in a separate meeting which actually amounted to a separate symposium.

The first symposium, which was devoted to the general problem of cartography, was opened with an introductory report by Corresponding Member of the USSR Academy of Sciences V.B. Sochava (Geography Institute of the Siberian Branch). After delineating the basic theoretical and methodological problems of vegetation cartography, he proceeded to give special emphasis to the necessity of coordinating activities among all of the institutions engaged in this field with the purpose of fulfilling the needs of the national economy to the maximum; he also pointed to the necessity for a wide intensification of efforts on the geobotanical mapping



of the newly-developed territories of Siberia and the Far East.

Three reports in this cycle (by T.I. Isachenko, A.S. Karpenko, Ye.V. Shiffers, all of the Botany Institute of the USSR Academy of Sciences) dealt with the principles and methods of generalizing geobotanical map content in the process of constructing maps to various scales.

A great deal of interest was aroused by the report of A.N. Lukicheva (Botany Institute of the USSR Academy of Sciences), which dealt with a construction of a single color scale for use in small-scale maps. Using the example of a vegetation map of Asia which the author constructed for the physico-geographical World Atlas (scale 1:17,000,000), which included almost all of the varieties of vegetation found on earth, she demonstrated the principles of selection employed in working out a color scale and gave a list of colors and shades to designate the main subdivisions of the earth's vegetative cover.

The second cycle of reports had to do with the results of mapping the vegetative cover of individual regions in our country. This subject was covered in the papers of A.V. Kuminova (Central Botanical Gardens of the Siberian Branch) on the results and future outlook of geobotanical cartography in Western Siberia, Z.V. Kubanskaya (Botany Institute of the Kazakh SSR Academy of Sciences) on Cartographic work in Kazakhstan, G.E. Kurentsova (Biology Institute of the Far Eastern Affiliate of the Siberian Branch) on the present state and tasks of geobotanical cartography in the Soviet Far East, and B.P. Kolesnikov (Ural Affiliate of the USSR Academy of Sciences) on results achieved in mapping the Urals.

The third symposium was devoted to a discussion of certain problems in mapping the vegetation of the Taiga zone and forest-steppe area on a medium scale.

B.P. Kolesnikov described the methods employed in constructing a medium-scale geobotanical map of the Primorskiy Kray, and formulated the basic theoretical and methodological principles that must be taken into consideration in constructing survey and formative medium-scale geobotanical maps.

Ye.E. Lapshina (Central Botanical Gardens of the Siberian Branch) reported on special problems involved in the construction of vegetation maps to a scale of 1:1,000,000, with special reference to the West Siberian territory; she likewise submitted for discussion a suggested legend and color scale for five maps drawn to the indicated scale, covering the sub-taiga, forest-steppe, and steppe zones of the south-eastern area of Western



Siberia, as well as the mountainous formations in the Altai and Kuznetskiy Alatau ranges.

Ye.L. Lyubimova (Geography Institute of the USSR Academy of Sciences) made use of a vegetation map of the Kanskaya forest-steppe region to show the special problems involved in mapping the vegetation of the forest-steppe depressions of Central Siberia.

V.V. Mazing (Tartu State University) spoke on the complex nature of the vegetative cover and the relation of typological and regional, phytocenotic and phyto-complex units in vegetation mapping.

The fourth symposium had to do with the problems of vegetation cartography and geobotanical territorial subdivision. Using as an example the botanico-geographic division of Western Siberia, L.V. Shumilova (Tomsk State University) described her experience of using various types of vegetation maps for regional subdivision. She also expressed the view that botanico-geographic subdivision must lie at the basis of complex natural-historic subdivision, and that the former in turn rests on geobotanical cartography. A confirmation and development of this thesis was given in the report of T.G. Abramova (Hydroelectric Power Scientific Research Institute of Leningrad State University) who used the example of a complex natural regional subdivision of the Vologodskaya Oblast. The use of geobotanical regional subdivision as a basis for agricultural and economic subdivision was demonstrated in the report of L.R. Laasimer, who demonstrated the delineation of economic and geobotanical regions in Estonia.

Several reports dealt with natural landscape cartography and its connection with geobotanical mapping. A.G. Isachenko (Leningrad State University) delivered an expensive and detailed report on this subject. He pointed out the necessity for complex mapping through the creation of a series of special natural maps as well as the construction of complex physico-geographic or topographic maps. K.G. Raman (Latvian State University) spoke on the classification of geographic landscapes in the Latvian SSR and the possibility of using the principles employed in its formulation in the field of geobotanical cartography.

A.G. Voronov (Moscow State University) described methods of biogeographic cartography and of the need for maps which would reflect the distribution of vegetative cover and fauna complexes over given territories. Such biogeographic maps would be most useful in the rational complex utilization of natural resources. In their paper, Ye.I. Ignat'yev and O.V. Shkurlatov (Geography Institute of the Siberian Branch) demonstrated the possibility of



using geobotanical maps and plans in the medico-geographic study of various territories, and especially in the development of medico-geographic prognoses for regions being subjected to intensive economic exploitation. The compilation of a comprehensive medico-geographic map of Siberia and the Far East requires the use of survey geobotanical maps covering the appropriate territories.

Much interest was aroused by the report on the use of phytoindicators in the construction of geobotanical maps. S.V. Viktorov (All-Union Aerological Trust) formulated the basic principles to be used in the construction of indicator maps, and demonstrated the most widespread types of geobotanical indicator maps: hydroindicative, lithoindicative, and maps showing territories of possible promise from the standpoint of useful ores.

B.N. Gorbachev and O.S. Gorozhankina (Rostov-na-Donu Soil Management Administration) studied plant indicators representative of strictly defined regions and stable under various agricultural conditions. On the basis of these indicator species, they constructed maps of the replenished vegetation in the steppe zone of Rostovskaya Oblast.

The papers having to do with forestry topics raised such problems as the creation of typological forest maps (V.A. Rozenberg--Biology Institute of the Far Eastern Affiliate of the Siberian Branch), the construction of maps on the basis of genetic forest classification (B.P. Kolesnikov), and the "lifespan" of forest and geobotanical maps (G.V. Krylov--Biology Institute of the Siberian Branch).

A number of reports had to do with maps of grazing lands, and the methods and principles of their construction (I.N. Sobolev--Geography Institute of the USSR Academy of Sciences, A.V. Kuminova--Biology Institute of the Siberian Branch, O.N. Nasonova--Botany Institute of the Kazakh SSR), while other papers had to do with geobotanical pasture map standards (I.A. Tsatsenkin--Feed Institute of the All-Union Agricultural Institute imeni Lenin).

Cartography of marshland vegetation was covered in only two general reports, while the problems of typology and methodology employed in constructing swampland maps to various scales were unfortunately completely ignored. A.S. Olenin (Glavtorffond--Main Peat Fund) presented a general survey report on the present state of peat bog cartography and demonstrated peat resource maps constructed by the Main Peat Fund Administration under the USSR Council of Ministers.

A group of staff members from the Aerial Methods Laboratory of the USSR Academy of Sciences reported on the use of aerial photography in mapping various types of



vegetation: forests, deserts, steppes, aquatic vegetation, etc.

The reports presented gave rise to lively discussions and critical remarks. Of great value were the comments made by production organization workers. Altogether 75 persons took part in the discussions following the reports.

A large cartographic exhibit was held during the time of the Conference within the meeting hall itself as well as in the adjoining rooms; this included over 280 vegetation maps of various types and covering different territories, executed both by Soviet and foreign specialists. The exhibit included the "Botanico-Geographic Map of the Russian Empire" of G.I. Tanfil'yev (1900) which is now a bibliographic rarity, as well as maps executed with the aid of modern aerial techniques.

Widely represented were medium-scale vegetation maps of the oblasts, krays, and republics of the Georgian SSR, Dagestan, Central Asia, the Estonian SSR, Irkutskaya Oblast, Novosibirskaya Oblast and Altay Kray, Vologodskaya Oblast, Primorskiy Kray, etc.

The scientific-editorial division of the State Geographical Cartography Administration demonstrated the wall maps it had prepared of the vegetation and soils of the entire territory of the Soviet Union. There were likewise mainly highly specialized maps--peat resource maps of Siberia and the Far East, forest maps, pasture land maps, grazing area maps, fenological maps, etc.

Thirty-eight foreign maps executed in nine countries (France, Spain, Italy, the U.S., the German Federal Republic, the German Democratic Republic, Rumania, Switzerland, and Sweden), as well as several maps of Africa and Madagascara executed under an international cooperative program supervised by UNESCO, made it possible for the conference participants to become acquainted with foreign cartographic schools. The explanations of the foreign maps under discussion were given by B.V. Sochava, while the rest of the maps were explained by specialists by those organizations which submitted the maps. The exhibit aroused great interest and promoted exchanges of opinions and information among the cartographers themselves.

After a thorough exchange of views, the conference adopted a general resolution outlining the basic tasks and future trends of development in the field of geobotanical cartography in our country.

The conference likewise noted the necessity for organizing specialized vegetation cartography laboratories within the framework of the USSR Academy of Sciences, the republican academies, and especially under the guidance of



the Siberian Branch of the USSR Academy of Sciences; it likewise emphasized the importance of solving the problem of publishing vegetation maps under the auspices of the various publishing houses operating within the Academy of Sciences; finally, the conference took cognizance of the urgent need for the prompt publication of finished maps in order to promote their extensive introduction and utilization.



NINTH SESSION OF THE SCIENTIFIC COUNCIL OF THE JOINT NUCLEAR  
RESEARCH INSTITUTE

/Following is the translation of an article  
by V. Biryukov in Atomnaya Energiya (Atomic  
Energy), No 3, 1961, pages 282-285./

The regularly-scheduled Ninth session of the Scientific Council of the Joint Nuclear Research Institute was held from 21 through 24 November, 1960. The Council heard the reports of its laboratory directors, vice-directors, and the Administrative Director of the Institute; it also considered scientific and financial plans for 1961 along with plans for future expansion.

A report on the work of the High Energy Physics Laboratory in 1960 was delivered by its Director, Academician V.I. Veksler. In accordance with the decision of the Council, the Laboratory has extended the operating time of its synchrophasotron and has likewise improved its operational stability. The accelerated particle beam intensity has been increased up to  $10^{10}$  protons/pulse. Already completed and operating are a number of power installations and safety devices which have considerably increased the operational reliability of the entire accelerator power supply system. Of great importance are the newly-designed devices and circuits for the stabilization of beam intensity at a given level, pulse length variation, etc. The accelerator has likewise been improved from the standpoint of the target system. Another newly-designed and built piece of equipment is the linear injector-accelerator which is presently being adjusted. A number of major methodological projects were completed at the Laboratory in 1960. The Design Bureau of the Institute and Laboratory has worked out an installation for the automatic processing of particle track photographs from the cameras. This piece of equipment is designed to operate in conjunction with the "Kiev" electronic computer which is set up at the Theoretical Physics Laboratory. The Eighth Session of the Scientific Council had already heard reports on the early phase of operations with a model of a new type



of accelerator--the ring phasotron [see note]. Experimental studies to determine the possibilities of such an accelerator are presently under way. Much interest on the part of the audience was aroused by the report of efforts presently being conducted on the creation of channels for the production of pure fast-particle beams. [Note: Atomnaya Energiya (Atomic Energy), 9, issue 2, page 146 (1960).]

The results of the basic experiments carried out by means of the synchrophasotron in 1960 were reported at the High Energy Physics Conference at Rochester (U.S.), held in late August, 1960 [see note]. Some results were already reported at the Eighth Session of the Scientific Council of the JNRI (Joint Nuclear Research Institute). One of the most important conclusions was obtained in the course of a project cycle devoted to the study of nucleonic structure. The study of angular particle dispersions in inelastic collisions of  $\pi$ -mesons and nucleons with nucleons showed that the distribution of nucleons in the mass center systems in these processes is sharply anisotropic; furthermore, the maximum corresponds to the direction of the initial path of the nucleon. Interesting and unexpected results were obtained in the study of angular particle dispersion in processes involving the formation of  $\Lambda^0$ - and  $\Sigma$ -hyperons. The distribution of these particles in the high energy range is analogous to the above-mentioned nucleon distribution at the particle production threshold, in contrast to an almost isotropic distribution. An analysis of the resultant data pointed to the important conclusion that at high energies, particles with a baryon charge are formed in peripheral collisions. [Note: Atomnaya Energiya (Atomic Energy), 10, issue 1, page 80 (1961).]

Several of the projects carried out at the High Energy Physics Laboratory had to do with the study of elastic nucleon-nucleon dispersion, as well as with the interaction of fast K-mesons with nucleons. With the aid of xenon and propane bubble chambers, it was possible to study the longitudinal polarization of  $\Lambda^0$ - particles produced in the process of  $\pi$ -meson-nucleon interaction at energies of 7.8 and 3 bev (billion electron volts). These experiments are being conducted with the aim of confirming the conservation of parity in "strange" particle production processes. The results obtained so far apparently testify to the presence of polarization, but are as yet insufficiently reliable to warrant any unequivocal conclusions.

The scientific research plans of the Laboratory for 1961 include the further study of parity conservation in strong interactions, strange particle production and disintegration processes in pion-nucleon collisions, the



correlative effects in the production of strange particles,  $K^0_2$ -mesons, nuclear structure, etc. Also included in the plan are programs on the study of weak interactions, in particular through the investigation of K-disintegration phenomena, K-meson mass differences, etc. Also of considerable scale is the plan for scientific-methodological development.

The Director of the Nuclear Problems Laboratory, Doctor of Physico-Mathematical Sciences V.P. Dzheleпов, reported to the Scientific Council on the results of the more important scientific research projects completed with the aid of the phasotron in 1960. The work of the scientific team working with this piece of equipment aroused great interest among the physicists of various nations at the Rochester Conference.

In accordance with the program of research efforts necessary for the determination of nucleon-nucleon dispersion amplitude at an energy of 650 mev (million electron volts), the Laboratory Physicists have carried out a complex experiment on the triple dispersion of protons by protons at this same energy; they have likewise determined the correlation of normal polarization components in p-p-interactions at an angle of  $90^\circ$  and obtained important information on the contribution of each of the forces involved. The spin correlation coefficient was likewise measured at an angle of  $90^\circ$  for a proton energy of 315 mev. These data were analyzed along with those obtained at Berkeley. Studies are still continuing on polarization effects in nucleon-nucleon collisions. Soviet scientists at the Rochester Conference likewise submitted processed experimental data on elastic n-p-dispersion with the aim of determining the  $\pi$ -meson-nucleon interaction constant with the aid of a new method which takes the two poles into account.

A part of the important work carried out at the laboratory in 1960 was already reported at the Eighth Session of the Scientific Council: these results have to do with the investigation of  $\pi$ - $\pi$ -interaction with the aid of photo emulsions, investigations to confirm the rigor of isotopic spin conservation in the  $d+d \rightarrow \pi^+ + \alpha$  reaction, experimental results on the angular distribution of  $\pi$ -mesons and the cross-section of meson formation by nucleons with isotopic spin equal to 0, as well as the results of measuring the value of the Panofsky ratio by new methods.

The speaker gave a detailed account of the studies presently being conducted at the laboratory on the timely problems of weak interaction. With the purpose of determining the  $M$ -meson-nucleon interaction constant, experiments are presently being performed on  $M$ -meson capture by nuclei.



In order to investigate one of the variants of  $\mu$ -meson-nucleon interaction, measurements were carried out of neutron angular distributions in  $\mu$ -meson capture in calcium. The treatment of the first results obtained indicate that the contribution of the pseudoscalar variant to the effective interaction twice exceeds the theoretically predicted value. These studies will be continued. In the study of hyperfine structure by means of  $\mu \rightarrow l$ -decay asymmetry (occasioned by spin interaction between a  $\mu$ -meson and an atomic electron shell), it was shown that this phenomenon is observed in the mesoatoms of the transition elements, actinides and lanthanides. In co-operation with the Theoretical and Experimental Physics Institute of the USSR Academy of Sciences, the Laboratory carried out in 1959-1960 a series of interesting experiments on non-radiative transitions in heavy  $\mu$ -mesoatoms. A scintillation spectrometer is being used in this work in order to study the spectra of mesoroentgen photons released by the  $\mu$ -mesoatoms of Pb, Bi, Th<sup>232</sup>, U<sup>235</sup>, and U<sup>238</sup> isotopes. An analysis of the spectra indicates the presence of a previously undetected non-radiative transition peculiar to heavy  $\mu$ -mesoatoms, in which the transition energy is conveyed directly to the nucleus. Among the other efforts, one should mention the studies of processes involved in  $\mu$ -mesoatoms and  $\mu$ -mesomolecules, the attempts to determine the radiation corrections for the  $\mu$ -meson magnetic moment, the  $\mu$ -meson spin direction, etc.

The Laboratory is likewise conducting studies of nuclear radiations in neutron-deficient isotopes formed in the irradiation of heavy targets by particle beams from the phasotron. Experimenters now have at their disposal in this work seven  $\beta$ -spectrometers of various types and classes of precision; scintillation spectrometry methods are also employed in this work. In 1960, studies have been conducted on the spectra of a number of neutron-deficient isotopes, the existence of several new isotopes has been established, and decay schemes for certain nuclei have been worked out. Several institutes in the Soviet Union, as well as Polish and Czechoslovakian institutions are taking part in this work. Some of the Laboratory Staff Members took part in experiments carried out with the aid of the synchrophasotron. A Wilson cloud chamber was used to study the properties of  $K^0_2$ -meson decay in a magnetic field; the data obtained in these experiments point to the possibility of extending the  $\Delta T = \frac{1}{2}$  selection rule to cover decay processes involving leptons. Nuclear photo emulsions were again employed in the study of angular and energy distributions of secondary particles in p-p- and p-n-collisions at energies of about 10 bev.



Theoretical work completed in 1960 included an examination of the problem of obtaining theoretical data from experiments with neutrino-meson beams; the analysis of  $\gamma$ -quanta dispersion by deuterons and more complex nuclei over a wide energy range below the meson production threshold, etc.

Much work was done at the Laboratory on the improvement of the phasotron and the development of new accelerators. A considerable role was played by efforts have to do with the creation of new experimental equipment. An installation with a liquid hydrogen-deuterium bubble chamber in a magnetic field has been successfully put into operation; it is presently being used with  $\pi$ -meson beams; adjustments are being made on a propane bubble chamber 200 litres in volume; designs for a 64-channel pulse height analyzer and a discharge-track camera have been completed; work is continuing on the creation of a polarized target and semiconductor particle detectors.

Academician N.N. Bogolyubov, Director of the Theoretical Physics Laboratory, told the members of the Council of theoretical researches and development directly bearing on the experimental side of research. The Laboratory staff members have carried out interesting work on the study of dispersion interrelations and spectral representations. The basic work in this area was described at the conference on dispersion relation theory held in May, 1960, under the auspices of the Joint Nuclear Research Institute [see note]. An important role in the work of theoreticians was played by the elaboration of various problems in quantum field theory and the study of strong nucleon interactions and structures. Of great importance to the experimental aspect of research are the calculations connected with experiments being conducted by physicists at the accelerators of the Institute: calculations of synchrophasotron particle beams, the angular and energy distribution and intensity of anti-nucleon beams,  $\gamma$ -quanta neutrinos, and strange particles; calculations on the basis of central and peripheral  $\pi N$ - and  $NN$ -collisions, etc. Successful efforts continued in the application of nuclear superfluidity theory to the solution of various problems. The speaker noted several projects in which theoreticians working along with experimentors carried out analyses of experimental data obtained with the aid of accelerators. These projects involved studies of  $\pi$ -mesons and nucleons with nucleons, mesoatomic and mesomolecular processes, parity conservation problems in strong interactions, and many other topics. [Note: Atomnaya Energiya, 9, issue 1, page 71 (1960)].



The research carried out at the Laboratory was described at the High Energy Physics Conference at Rochester, where it received the deserved acclaim of the world scientific community.

Special mention was made by N.N. Bogolyubov of the cycle of theoretical projects on high energy neutrino physics carried out at the Theoretical Physics and Nuclear Problems Laboratories. The Rochester Conference demonstrated that work with high-energy neutrinos is one of the most important and promising areas of modern physics.

The Theoretical Physics Laboratory is continuing the successful development of the Institute Computing Center. In addition to the presently-available "Ural" Calculator, the Laboratory received two new electronic computers in 1960. The Laboratory staff introduced considerable improvements into the circuitry of the "Kiev" computer in order to enable it to solve specific experimental data processing problems. N.N. Bogolyubov reported that both computers would be put into actual operation early in 1961. A great deal of work is being done on the creation of a standard program library for the machines.

The Laboratory scientific research plan for 1961 includes the completion of studies on the basic program presently being developed at the Laboratory; this work has been going on for the past several years.

The members of the Scientific Council also heard the report of Corresponding Member of the USSR Academy of Sciences I.M. Frank, the Director of the Neutron Physics Laboratory, on the construction of a pulse reactor, new buildings being added to the Laboratory, as well as on developments in the way of new physical and electronic apparatus. The Scientific Council confirmed the basic research plan for the laboratory in 1961 and pointed out the necessity for its continual implementation with new equipment.

The report of Corresponding Member of the USSR Academy of Sciences G.N. Flerov, Director of the Nuclear Reactions Laboratory, contained information on the creation of a multiple-charge ion accelerator, as well as on the completion of new construction and assembly projects at the Laboratory. Among the major efforts of the Laboratory in 1961, the Scientific Council noted the completion of experiments on the synthesis of new transuranium elements, as well as the development of new apparatus and rapid methods of isolating transuranium elements.

Professor Van Gan-gan, Deputy Director of the Institute, told of the development of international ties of the Joint Nuclear Research Institute. He mentioned that scientific efforts in 1960 carried out with the aid of



nuclear emulsions irradiated by means of the synchrophasotron were carried out in Bulgarian, Hungarian, East German, Chinese, Polish, Rumanian, and Czechoslovakian institutes. A special committee headed by Professor V. Petrzilka is coordinating these efforts, generalizing the research results, and providing the irradiated photo emulsions. In July, 1960, this committee for the first time summed up the results of research carried out with the aid of photoemulsions in countries cooperating with the Institute and collected the best papers for presentation at the Rochester Conference; it likewise made a detailed outline of future work plans. There is also increased cooperation with studies with the aid of bubble chambers. A first group of several thousand photographs obtained with a propane chamber of a seven-bev  $\pi$ -meson beam, has been dispatched to Warsaw, Budapest, Berlin, and Bucharest. The cooperative processing of photographs obtained with the Xenon chamber is due to begin shortly. A committee to coordinate research using bubble chambers under the chairmanship of I.V. Chuvilo, Deputy Director of the High Energy Physics Laboratory, was likewise confirmed. Work is continuing on the irradiation of various preparations by means of the phasotron as a part of radiochemical and spectroscopic studies being conducted in Poland and Czechoslovakia.

In addition to the conferences already mentioned, the Joint Institute the Third series of conferences on nuclear spectroscopy with special reference to neutron-deficient isotopes, and a conference on the problems involved in constructing a cyclotron for multiple-charge ion acceleration. The plan for 1961 includes conferences on research carried out with the aid of bubble chambers, automatic nuclear emulsion and track photograph processing, weak interactions, nuclear spectroscopy, slow neutrons, as well as on the theory of dispersion relations, elementary particle structure, and strange particle properties.

Many Institute staff members made trips to the countries participating in the Institute program to take part in conferences and seminars to present lectures, exchange opinions, etc. The Institute researchers took part in conferences on high-energy physics at Rochester and Weimar, a conference on the use of isotopes in physics and industry at Copenhagen, a symposium on chemical effects in nuclear transformations at Prague, and a symposium on inelastic interactions at Vienna. Several theoreticians and experimenters from the Institute spent several months working at CERN (European Organization for Nuclear Research), in the United Arab Republic, and at the Theoretical Physics Institute at Copenhagen.

Deputy Director of the Joint Institute, Professor E. Dzhakov described the work of staff members at the



Institute from the countries participating in its program (excluding the USSR). The number of such researchers has increased considerably during the last year. In addition to this, numerous scientists visited the Institute for a short period in order to become acquainted with individual problems and experimental installations. At the present time, researchers from the cooperating countries are included in almost all of the scientific research teams and construction bureaus engaged in the development of new installations. They are taking an active part in the Institute's research and are making a significant contribution to the activities of the Institute.

The Scientific Council likewise examined the fiscal and budgetary proposals and building plans of the Joint Institute for 1961, considered individual discovery rights, and confirmed the new staff rosters of the Institute Laboratory councils.

The meetings of the section on low-energy nuclear physics were held concurrently with the Ninth session of the Joint Council. These included reports on the results of conferences held in 1960: the Dresden Working Conference on Reactor Physics and Technology, the Balaton Colloquium on Low-Energy Nuclear Physics, as well as the Working Conference on Nuclear Spectroscopy at Dubna. The Section noted the fruitful results of these conferences and the considerable interest they aroused in many of the institutes cooperating in the Joint Institute program. The Section Chairman, Corresponding Member of the USSR Academy of Sciences I.M. Frank, presented a report on the proposed research plan for the Section. The Section adopted a resolution calling for the convocation of working conferences to promote exchanges of information on work experience and scientific research with the aid of cyclotrons (Krakow, April-May 1961), as well as on research topics to be investigated with the aid of the multiple-charge ion accelerator (Dubna, 1961), nuclear spectroscopy with reference to neutron-deficient nuclei (Dubna, June 1961), physics research with the aid of slow neutrons (Dubna, October 1961), as well as on the problems of polarized ion beam and polarized target sources (Dubna, early in 1962). The cooperative research plan for the Joint Nuclear Research Institute and the nations cooperating in the Institute program in the field of low-energy physics includes projects on neutron-deficient isotope spectroscopy, the study of photo-electret phenomena, studies of solid and liquid substances by the cold neutron dispersion method, the development of an ironless  $\beta$ -spectrometer, and cooperation in the completion of new radio electronic equipment.



## CONFERENCE OF THE REPRESENTATIVES OF TWELVE GOVERNMENTS

Following is the translation of an article by V. Biryukov in Atomnaya Energiya (Atomic Energy). No 3, 1961, page 285.

A regular session of the committee consisting of the governmental representatives from the several countries participating in the Joint Nuclear Research Institute program was held on 25-26 November, 1960, at Dubna.

In a survey report, the Director of the Joint Institute, Corresponding Member of the USSR Academy of Sciences D.I. Blokhintsev summarized the work of the Institute over the years 1956-1960 and described the plan for research at the Institute for the next five years. The Committee noted the successful fulfillment of the development plan and research projects on the part of the Institute laboratories in 1960 and approved the scientific research plan for 1961 adopted by the Scientific Council. The resolution acknowledged the considerable aid given by the USSR, as well as Poland, Czechoslovakia, and the German Democratic Republic in the construction and equipment of both new and old Institute laboratories. The Committee took special note of the important results achieved in the development of ties between the Joint Institute and scientific institutions in various countries; it went on to recommend an extension of the practice of commandeering the Institute researchers to various foreign countries in order to exchange work experience and conduct cooperative research.

Approval was given to the projective plan for Institute development covering the years 1961-1965 as submitted by the Institute administration. The basic research trends pursued at the Institute are to remain unchanged; basic research in the field of elementary particle physics (structure of particles, mainly nucleons, as well as particle formation and interaction laws) and nuclear physics will remain the main interests. The most important projects designed to assure the extensive projected program of physics research are the intensification of accelerated particle beams at the main installations--the synchrocyclotron and synchro-



phasotron, as well as the further development of experimental data processing automation.

On the basis of the report presented by V.N. Sergienko, Administrative Director of the Institute, the Committee adopted a resolution confirming the fiscal report for 1960, the financial report for 1961, the construction plans, and the staff allocation of the Institute.

In connection with the expiration of tenure of the Institute Deputy Directors, the Committee held elections to these posts. Chosen to serve as the new Deputy Directors of the Institute were well-known scientists Professor Heinz Barwich, Director of the Central Nuclear Research Institute of the German Democratic Republic, and Tudor Tenesescu, Corresponding Member of the Rumanian Academy of Sciences.



RESULTS OF THE COMPETITION OF THE LENINGRAD OBLAST BOARD  
OF THE SCIENTIFIC-TECHNICAL SOCIETY OF THE SHIPBUILDING  
INDUSTRY

Following is the translation of an unsigned  
article in Sudostrovenie (Shipbuilding)  
No 3, 1960, page 75.

The Leningrad Oblast Board of the Scientific-Technical Society of the Shipbuilding Industry in December 1960 undertook to judge the 1960 contest for the best results achieved in the development and introduction into shipbuilding practice of new techniques, progressive technological methods, and production organization methods.

The contest commission received 84 entries from 25 primary organizations. Four hundred and seven members of the Scientific-Technical Society took part in the contest. On the basis of expert opinion, the contest commission submitted its judgement on the value of each entry. The 16 best entries were sent by the commission to the contest held by the Central Administration of the Scientific-Technical Society.

The Presidium of the Central Administration awarded prizes to eight entries.

The first prize of 3000 rubles [see note] and an honorary scroll was awarded to two entries--"An Experimental Aluminum Alloy Compartment" (submitted by an engineering collective) and "The All-Welded Superstructure of a Passenger Vessel made of Aluminum Alloys" (submitted by an engineering collective). [Note: amounts indicated in terms of the 1960 ruble.]

The second prize of 2500 rubles and an honorary scroll was awarded to the following entries:

"Control of the General Strength of Floating Reinforced Concrete Docks" (V.V. Kozlyakov, V.A. Il'yin, S.I. Repin);

"The Mechanized Chemical Cleaning of Sheet Steel" (I.M. Sidorenko);

"Metal Coating of Wooden Models" (A.A. Karpov, P.I. Bulkin, Fominskiy);



The third prize of 2000 rubles and honorary scroll was awarded to the following:

"An Eddy-Foam Device for Air Condensation" (S.A. Bogatykh, V.N. Kornev); the Presidium of the Leningrad Oblast Board of the Scientific-Technical Society also awarded prizes following the announcement of the contest held by the Central Kiev administration of the Scientific-Technical Society.

The first prize of 1500 rubles and honorary scroll was awarded to the following:

"Experiences in Producing High-Pressure Ship Fittings by a Liquid Metal Stamping Method" (N.A. Petrov and B.S. Tur'yev);

"A Laboratory for Simulating Unsinkability Problems: Its Planning and Organization" (submitted by a group of authors).

A second prize of 1000 rubles and an honorary scroll was awarded to ten entries, including "The Application of Rubber Stopcock Valves in Vessels of Various Classes and Moorings" (S.I. Ukhin, V.A. Starshinov, A.N. Kaverznev); "On Voltage and Frequency Levels in Marine Power Installations" (G.I. Kitayenko); "The Choice of Sheetting Resistant to Hydrochloric Acid" (A.A. Tikhomirov, M.P. Genkina, V.M. Mayorova); "On the Rational Distribution of Material in an Equivalent Beam for the Case of Minimum-Weight Aluminum-Magnesium Alloy Hulls" (A.S. Braynin, Ya.B. Kaganer, A.S. Kriksunov); "The Organization of Continuous Pipe Flange Production" (submitted by a team of authors).

The third prize of 500 rubles was awarded to 19 entries; 24 entries received honorary scrolls.

The Leningrad Oblast Board noticed a considerable heightening of interest in the annual contest on the part of the Society members. The Board expects that the 1961 contest will attract an even greater number of actual entries from the primary organizations of the Scientific-Technical Society at the Leningrad Shipbuilding Enterprise (Sudprom) and the other shipbuilding organizations in the Oblast.



WORK OF THE SCIENTIFIC-TECHNICAL SOCIETY OF THE  
SHIPBUILDING INDUSTRY; CONFERENCE OF SHIPBUILDING  
WELDERS

Following is the translation of an unsigned  
article in Sudostroveniy (Shipbuilding),  
No 4, 1961, pages 80-81.

A conference of shipbuilding welders held under the auspices of the Leningrad Council of the National Economy and the welding section of the Scientific-Technical Society of the Shipbuilding Industry was held in December, 1960, at Leningrad. The conference served to throw light on the introduction of achievements in welding technology into industrial practice and exemplary welding enterprises. It was attended by over 120 representatives from 12 Soviet cities.

In opening the conference, the Assistant to the Chief Engineer of the Shipbuilding Administration of the Leningrad Council of the National Economy Comrade Stepanov emphasized the exceptional role of welding in the shipbuilding industry. The tasks posed by the Party and State in the resolutions of the 21st Party Congress and the July 1960 Plenum of the CPSU (Communist Party of the Soviet Union) Central Committee confront shipbuilding welders with the responsibility of completing these tasks fully and ahead of schedule.

In his report, Engineer N.M. Nikitinykh examined the problems involved in mechanizing the gas cutting process and automating the welding of prefabricated hull components. Gas cutting is performed mainly with the aid of equipment controlled by means of a remote photo-duplicating system (MDFKS). The report included figures characterizing the economic effectiveness of employing such machines. The speaker likewise noted measures directed at increasing the productivity and lowering the labor expenditure stemming from the mechanization of gas cutting operations (the mechanization of flange cutting, the use of propane-butane as a substitute for acetylene, etc.).

Electrical slag welding of external hull plate seams on tankers of the "Peking" type is performed by means of



automatic A-433M welders designed at the Electrical Welding Institute imeni O.Ye. Paton. A number of significant changes introduced into the design of the automatic welder made it possible to convert from arc welding to the electrical slag method. Each tanker has 24 welded seams with a total length of 300 meters. Electrical slag welding by means of A-501M automatic welders is widely employed in the construction of flat sections and boiler shells from sheets exceeding 16 millimeters in thickness. The speaker reported on efforts to master the electrical slag welding of forge-cast ballhead governors.

Engineer P.D. Korobov told of efforts being conducted toward the mechanization of thin-walled structure welding using aluminum-magnesium alloys. Until recently, such structures were welded by hand with the aid of non-melting electrodes in an argon atmosphere. The realization of a number of measures made it possible to assure high welding quality. These included the construction of devices and equipment, the elaboration of the technological welding process and the training of cadres. A special workshop for the production of aluminum alloy structures was organized; there the metal is processed and the separate components are assembled and welded. The workshop now conducts continuous component production.

Recent developments have included a method for forced seam metal protection by means of gas through the replacement of the standard nozzle by an injector-type tip.

Welding process mechanization is progressing continuously. The ADSB-1 and PShV-1 installations have been introduced recently. Preliminary tests reveal the necessity for removing oxide films from metal edges and especially from overlapping plate surfaces, since the presence of an oxide makes the seam porous. The presence of an oxide film on the reverse side is, on the other hand beneficial, since it hinders the leakage of metal while it is being welded in a suspended position.

Engineer V.S. Golovchenko characterized the present state of welding technology at the shipbuilding enterprises, describing in particular the mastery and introduction of progressive welding methods, especially mechanized welding in a protective gas atmosphere.

The speaker placed special emphasis on the two following problems:

The welding of ship hulls made of low-carbon and low-alloy steels. The basic method of increasing the volume of mechanized welding is the introduction of semi automatic welding in a carbon dioxide atmosphere.

Aluminum alloy welding. This technique has been introduced at many factories. A great number of welders has



already been trained;

Contact welding. The contact welding of prototype vessel structures is being widely introduced. Factories must be specially equipped to handle this type of work. The mastery of glued joints is also included in future plans;

The welding of marine plumbing and fittings. Much work has been done on the development of automatic devices and the technology of rust-resistant type welding. A method of argon arc welding for copper-nickel types has been developed; special solders have been developed to replace silver;

Electrical slag welding of stem- and stern-posts and ballhead governors. Methods have been worked out for the electrical slag welding of forge-cast structures from various grades of thermally untreated steels. Such structures are built and assembled aboard ship.

In conclusion the speaker called upon the factory workers to strengthen their ties with research organizations.

Engineer B.I. Smirnov spoke on the problem of the electrical welding of plastics used to protect walls and bulkheads in various vessel enclosures by means of high-frequency currents. The method of joining plates was something of a problem until recently. The manual hot-air welding method with its low efficiency (0.3-0.5 meters/minute), the necessity for much preparation, and insufficiently high seam quality has been replaced by a high-frequency current welding method which provides the following advantages: mechanization of the welding process, an increase in efficiency of 200-250%, and the reduction of the quality of technological operation.

The speaker adduced detailed data on the technological process and the required equipment.

Engineer L.B. Tonkonogov told of work experience in the use of electrical slag welding, mentioning that the A-433 apparatus was used to weld the outer plating of "Kazbek" type tankers, the marine whale processing base "Sovetskaya Ukraina" and the dry cargo vessel "Fizik Vavilov". Following the construction of some uncomplicated additional equipment, the method was used to weld the seams of deadwood collars made of steel 25-70 millimeters in thickness. The next stage was to master the welding of large castings. After some reconstruction of the A-372r apparatus and the TShS-600-3 power supply, it turned out to be possible to use the electrical slag method to weld the stem- and stern-posts of vessels of the type represented by "Sovetskaya Ukraina", "Fizik Vavilov", and "Kazbek".

Also mastered was the electrical slag welding of a forge-cast ballhead steering governor. At the present



time, forge-cast ballhead governors are being produced for trawlers of the "Mayakovskiy" type, hydrographic vessels of the "Akademik Shokal'skiy" type, refrigerator vessels, etc.

The speaker described in detail the techniques employed in the production of forge-cast structures with the aid of electrical slag welding, giving information on welding conditions and the mechanical properties of welded seams

Engineer Ye.F. Petrov shared his experiences in semi-automatic welding in a carbon dioxide gas atmosphere in the production of metal structures. The speaker noted that in so far as a thin wire (0.8-1.2 millimeters) is used in carbon dioxide welding, this method must be employed in welding butt joints from steel plates 2-6 millimeters in thickness and angular (tee) joints of thickness 3-7 millimeters. The equipment used in this work are the A-547r semi-automatic welders with VS-200 power supplies and A-632 welders designed at the Institute imeni O.Ye. Paton. The great advantage of carbon dioxide semi-automatic welding is the possibility it affords of making thin angular welds.

Taking into account the unquestioned advantages of semi-automatic carbon dioxide welding, the speaker considers it necessary to equip factories with the necessary equipment in the shortest possible time.

Engineer A.Ye. Vaynerman described the mechanization of welding processes in the construction of pipes and other shapes from steel and non-ferrous metals. All steel piping is welded by means of a mechanized technique in a carbon dioxide atmosphere. Flanges are welded on automatically with the aid of a reconstructed SKS-1 automatic welder, while semi-automatic welding is carried out by means of a PDPG-300 automatic welder and a reconstructed PSh-5 installation. The welding of steel pipes is 90% mechanized.

Work on the mastery of steel-copper welding is continuing.

The automatic welding on of pins is carried out without any protective medium whatsoever. In the opinion of the speaker, the selection of a proper welding range and depth of immersion of the welded pin can assure a process wherein the pin penetrates to a sufficient depth in the welding pool where the influence of the surrounding air is negligible. The mechanical properties of the weld make it possible to bend the welded pin by as much as 90° without affecting the monolithic character of the structure.

The welding of aluminum-magnesium alloys is carried out over a layer of flux with the aid of an ADSP-401 automatic welder.



The speaker gave a detailed description of the problems involved in the methods of welding the aforementioned items.

Engineer A.A. Vychegzhanin in a report devoted to the present phase of introducing hull structure welding in a carbon dioxide atmosphere, related the history of the development of this method.

At the present time, work is being conducted on the further extension of semi-automatic carbon dioxide welding, particularly in the area of 16-22 millimeter butt joints in all spatial orientations.

Engineer B.L. Tayts told of work on the creation of new types of welding equipment to be used in shipbuilding.

Engineer Ts.V. Shaban spoke on the use of modernized ADS-500 automatic and TIP-10 semi-automatic welders for the automatic and semi-automatic argon arc welding of aluminum-magnesium alloys. Due to the shortage and relatively high cost of argon, however, argon arc welding has been partially replaced by contact seam welding by means of the MShP-150 machine. At the present time, the MTIP-1000 machine has been introduced; this apparatus makes it possible to weld on fittings on to plates. The speaker cited work on the introduction and mastery of melting electrodes in the welding of aluminum alloys.

Candidate of Technical Sciences G.A. Bel'chuk described the work of the welding department of the Leningrad shipbuilding Institute on the mastery of aluminum alloy-steel welding which is being conducted in cooperation with factory laboratory researchers.

Engineer Ye.G. Faynshteyn spoke on the problems of carbon dioxide welding.

Engineer V.N. Chulkov told of a newly developed flux for welding aluminum alloy pieces of great thicknesses which is composed of readily available elements.

Candidate of Technical Sciences D.D. Matskevich recommended the use of the reconversion table for angular seam calibers and suggested that mention be made in the resolution of the necessity for further changes in the angular seam table, since a survey showed that factories are presently overestimating seam calibers.

Engineer G.D. Shteynfel'd shared his experience of introducing automatic vertical butt welding for external hull plating under dockyard conditions. Instead of two hours, manual welding just requires 20 minutes, i.e. six times less time. Great difficulties are encountered due to the lack of spare parts for automatic welders.

Engineer A.V. Mikonov devoted his talk to efforts directed at the further study of carbon dioxide welding.



including its technological aspects and safety techniques. Comrade Nikonov gave a particularly detailed account of carbon dioxide gas quality.

Engineer N. Tysovskaya noted the timeliness of the task of automating the armature soldering process. Factories are in need of good automatic welders and ceramic fluxes. There is also an insistent need for mechanizing the cutting of steel and particularly non-ferrous castings.

The conference adopted resolutions whose realization will make possible the further improvement of welding techniques in factories.



## ELEVENTH SCIENTIFIC-TECHNICAL CONFERENCE ON SHIP THEORY

Following is the translation of an article by M.M. Bun'kov and I.T. Yegorov in Sudostroveniya (Shipbuilding), No 4, 1961, pages 81-83.

The annual eleventh scientific-technical conference on ship theory, organized by the seagoing properties section of the Central Administration of the Scientific-Technical Society of the shipbuilding industry, was held on 13-15 December, 1960.

The conference was opened by Academician Yu.A. Shimanskiy, who greeted the delegates and awarded honorary scrolls to the winners of the prize imeni Academician A.N. Krylov (note: the present issue likewise contains a summary of the results of the contest for the A.N. Krylov Prize).

The conference was attended by 250 representatives from 55 organizations--building bureaus, factories, scientific research organizations, and higher educational institutions in various Soviet cities.

The conference participants heard and discussed a number of reports on the following topics in ship theory.

### 1. "Water Resistance to the Movement of Vessels"

The paper presented by V.G. Sizov entitled "The Theory of Ship Resistance Under Ordinary Swell Conditions" examined the problem of determining the hydrodynamic forces acting on a ship moving under conditions of regular and ordinary swell on the basis of assumptions drawn from low-amplitude wave theory. This study resulted in the derivation of formulas which make it possible to determine the hydrodynamic forces acting on a vessel as it moves at any angle relative to the waves.

The report of L.F. Kozlov contained a theoretical investigation of the transition of the laminar layer into the turbulent state in the presence of suction, flow turbulence, and surface roughness of the moving body.



## 2. "The Resistance of Vessels Under Enclosed Waterway Conditions"

The report of V.Ye. Pyatetskiy entitled "A Study of Simplified Contours for Cargo Vessels Sailing on Restrictive Waterways" contained materials useful in the design of vessels with simple contours. The problem is solved with the aid of gas hydrodynamic analogue methods as a result of the similarity of the differential equations describing the motion of gases and fluids along open channels with horizontal bottoms. In this analogue, the analogy of the velocity of sound propagation in a gas is the rate of surface wave propagation in an incompressible fluid.

The report of O.G. Dudchenko entitled "Water Disturbances Arising as a Result of the Motion of a Vessel Along a Channel at Hypercritical Speeds" examined the problems of vessel resistance and settling for various forms and sizes of vessels and waterways, wave formation and changes in wave patterns along the sides of the vessel, as well as the distribution of wave pressure and streamline flow rates along the channel cross-section. Most of the attention was devoted to finding such parameters for the motion of a vessel along a channel at hypercritical speeds as would assure minimal water turbulence.

## 3. "Motion on Underwater Hydrofoils and Air Cushions"

The paper of S.D. Prokhorov on the use of the principle of motion on an air cushion represented a systematic survey of research efforts in the field published in foreign periodicals. The speaker presented a critical description of various air cushion vessel designs, concurrently presenting their hydrodynamic analysis.

The paper of Yu.M. Sadovnikov entitled "Several Properties of Calculating Underwater Hydrofoil Vessel Mobility" was devoted to a study of the effects of propellers on the resistance, propulsive properties, and carrying ability of vessels based on underwater hydrofoils. The speaker derived relations for determining the aforementioned effects of propellers and showed that the latter likewise represent support elements along with the hydrofoils. Taking into account the carrying capability of propellers makes it possible to carry out more precise calculations of the mobility of vessels based on underwater hydrofoils.

The report of I.T. Yegorov entitled "Hydrodynamic Forces in the Motion of a Support Hydrofoil in the Neighborhood of the Turbulent Water Surface" considered the unstabilized motion of a thin foil under conditions of regular swell.



The problem was solved assuming high relative velocities for the basic forward motion of the foil. This resulted in the derivation of formulas which make it possible to determine the hydrodynamic forces acting on an underwater hydrofoil in non-stationary motion under regular swell conditions. An actual example was used to present a detailed analysis of the fact of poor "wave mounting" on the part of underwater hydrofoil vessels moving along in the direction of swell.

The materials submitted in the aforementioned paper can be used in the designing of air cushion vessels, calculating mobility, and working out methods of calculating pitching motions for the case of underwater hydrofoil vessels.

#### 4. "Ship Propellers"

The report of V.V. Kopeyetskiy entitled "Velocity Fields Arising as a Result of Light Propeller Loading" had to do with the analysis of methods for calculating the velocities arising as a result of the free-eddy blanket surrounding the propeller. The analysis was carried out on the basis of results obtained by A.M. Lepilkin who studied the velocity field created by propeller elements. The author supposes that using the formulas derived by A.M. Lepilkin, it is possible to simplify the calculation of velocities set up by the propeller and to check the precision of induction factor calculations contained in the writings of Lerbs and Strzheletskiy.

The paper of V.M. Ivchenko on optimum propeller complexes had to do with an approximate theoretical solution to the problem of determining conditions under which the propeller loses a minimum amount of its kinetic energy as it rotates in the irregular lateral stream behind the hull of a ship. The author obtained an expression for the propulsive coefficient of a propeller element which satisfies the above condition. It was shown that certain solutions are obtained as special cases of the author's general results provided that the effects of viscosity or irregularities in the velocity field distribution in the lateral stream are neglected.

The paper of S.V. Kulikov entitled "Designing a Jet Propeller" contained a generalized theoretical treatment of studies carried out by N.Ye. Zhukovskiy and A.M. Basin on determining the external characteristic which establishes the connection between the pumping characteristics of the jet and the thrusts, taking into account the hydrodynamic studies on actual models equipped with jet propellers.



He likewise examined the problem of the most expedient design for the working parts of the jet according to the given external characteristic (this involved an analysis of pumping diagrams given in dimensionless coefficients according to the analogy with propeller action curves in free water).

In conclusion, he demonstrated the connection between the critical cavitation number of the jet and the criterion employed in pump construction, as well as the critical propeller cavitation number operative within the jet tube.

The report of Ye.I. Stepanyuk entitled "Experimental and Theoretical Studies of Jet Propeller Operation" dealt with studies on jet propellers carried out by the Leningrad Military Engineering Technical School in recent years. The theoretical portion of the report described the derivation of simple formulas for evaluating jet efficiency on the basis of the well-known method of jet flow theory. The experimental portion covered the results of systematic studies on a number of propellers in a water ejection tube which made it possible to evaluate the effects of the form and dimensions of the ejection tube discharge nozzle, as well as of the method of water ejection (above, below, or partially above water) on the efficiency of the jet.

The materials presented in this category can be used in construction bureaus in designing new vessels and modernizing existing ships equipped with propellers and jet engines.

#### 5. "Cavitation"

The report of A.D. Pernik entitled "The Initial Stages of Cavitation" dealt with the problem of scaling effects in cavitation, which assumes great importance in connection with the necessity of carrying out model experiments and extrapolating the results for actual dimensions. Experiments devised by the author made it possible to establish several new relationships and to work out a definite view of the physical nature of the scaling effect. Further developments in this direction will make it possible to render more precise calculations.

In addition to this, A.D. Pernik delivered a brief commentary on the papers of L.A. Epshteyn, "On the Nature of Energy Losses in Streamline Flow Around Bodies with Low Cavitation Numbers", and of L.A. Epshteyn, P.S. Starodubtsev, and S.I. Blyumin, "The Effect of Cavitation and Froude Numbers on Cavity Size and the Amount of Air Necessary for its Maintenance".



## 6. "Stability and Pitching Motion"

The paper of S.M. Trabinin entitled "On Calculations of the Defraction Component of Turbulent Forces in Vessel Pitching on an Oblique Course" makes use of the flat cross-sectional hypothesis in the approximation of the longitudinal vessel cross-sections by means of semi-ellipses; this enabled the author to reduce the problem to the study of flow around an infinitely semi-elliptical cylinder in a regular progressive wave whose front is not parallel to the generatrix of the cylinder. He obtained formulas which make it possible to calculate the defraction component of turbulent forces in the case of oblique motion on the part of the vessel relative to the waves.

The report of V.V. Lugovskoy entitled "On the Study of Hydrodynamic Forces in Limited Amplitude Pitching" contained an analysis of the well-known paradox in vessel pitching theory connected with the problem of linearizing the problem. The author formulated the general problem of limiting-amplitude pitching, pointed out its difficulties, and indicated how it could be solved. He solved the corollary problem involving limiting-amplitude waves arising from underwater action, whose intensity varies in accordance with a biharmonic law. He likewise found a value for the velocity potential and the form of the free surface in the second approximation. In addition to this, he presented an approximate evaluation of the effect on wave resistance of the non-linearity of the boundary condition in the case of a free surface. He pointed out that this effect is negligible in the case of the low-frequency fluctuations characteristic of rolling motion; in the case of the higher frequencies characteristic of longitudinal pitching, however, it exhibits a significant increase.

The paper of N.B. Sevast'yanov entitled "On the Problem of Controlling the Stability of Fishing Vessels at Sea" was devoted to the problem of controlling fishing vessels under conditions of actual use. This control is to be realized in accordance with the well-known formula which connects the metacentric height of the vessel with its proper lateral pitching. Using the method of static pitching theory, the author showed that the mean lateral pitching period under irregular swell conditions is very close to the actual proper period. This conclusion is confirmed by an analysis of the results obtained in the course of experiments, provided that the mean pitching amplitude exceeds a certain level (about 2 degrees). These studies were used to develop and construct a device known as the "metacentrograph".



The paper by V.V. Semenov-Tyan-Shanskiy, Yu.I. Fadeyev, and G.N. Tkachuk entitled "The Determination of the Hydrodynamic Characteristics of the Lateral Pitching of Marine Transport Vessels on the Basis of Results Obtained in a Series of Tests" told of results obtained in systematic serial tests on models of marine transport vessels performed in order to determine resistance coefficients and added moments of inertia in lateral pitching. Upon processing the experimental data and generalizing the theoretical results obtained, the authors obtained graphs which make it possible to determine the above-mentioned hydrodynamic lateral pitching characteristics for vessels in the case where

$$\frac{B}{T} = 2.5 \div 3.5; \delta = 0.59 \div 0.74$$

The report of V.I. Korolev entitled "Water Resistance in Longitudinal Vessel Pitching contained data which make it possible to calculate vertical and keel pitching resistance of ships on the basis of the flat cross-section hypothesis. These data were obtained from an analysis of experiments carried out on a series of cylindrical models. The determination of the resistance was carried out in accordance with the power expended on the maintenance of forced vibrations established in a model rigidly attached to a vibrator. The effects of various parameters on the magnitude of the resistance was also investigated. Separate experimental evaluations were made of the 3-dimensional character of the streamline flow on the magnitude of the resistance.

## 7. "Ease of Control and Manoeuvrability"

The paper of K.K. Fedyayevskiy on the rotational derivatives of a thin foil with smallest possible elongation corresponding to the arbitrary form of a vessel projection on a diametric surface, contained the justification of hypotheses first put forth by the author in the process of deriving formulas connecting rotational derivatives of a thin foil with smallest possible elongation to the hydrodynamic position characteristics of these foils. The paper demonstrated that the author's formulas correspond with the exact solutions to the problem for cases where the foils have a straight rear edge, as well as where the foil has a triangular shape with a straight frontal edge. In the case of a foil for which the local span decreases from the maximum span cross-section (not coinciding with the front edge) all the way to the rear edge, the author derived formulas improving on the former solution.



In his report on the problem of calculating hydrodynamic forces which determine the ease of control on a vessel sailing along with the current, D.M. Anan'yev attempted to use a calculative approach to determine the turbulent transverse force and turbulent yawing moment acting on a vessel as it moves along a regular swell. The "Krylov" components of the force and moment were determined for the case of a semi-submerged ellipsoid. The diffractive forces and yawing moment arising as a result of turbulence were calculated on the basis of formulas derived by M.D. Khaskind for the case of a semi-submerged ellipsoid. The paper likewise concluded formulas for calculating the force and moment on the basis of the flat cross-section hypothesis (assuming a flat streamlined flow around each rib of the hull). In performing these calculations, the author made use of results obtained earlier in the theory of lateral pitching by M.D. Khaskind and G.A. Firsov. All of the calculations were carried out for a stationary vessel. The author assumes that the results obtained are likewise applicable to a moving ship.

The report of K.K. Fedyaevskiy, L.Kh. Blyumina, and V.G. Grebennikov on the study of the hydrodynamic characteristics of a minimally elongated dihedron in unstable motion, contained a description of experimental studies of a phenomenon called "damping loss", which consists in a change of sign for the rotational derivative moments in testing bodies in a wind tunnel by the method of forced vibrations. The paper contained a description of the experimental conditions under which this phenomenon takes place, as well as data resulting from special experiments on the measurement of pressure distribution over a body, performed in order to investigate the reasons for "damping loss". In their report, the authors pointed out that "damping loss" can take place only with a large angle of attack (over  $60^\circ$ ) and in cases where the Strouhal number differs from zero. In the region of Strouhal numbers close to zero, the sign of the rotational derivative moments does not change; for this reason, the aforementioned phenomenon is not supposed to take place with real vessels.

The report of A.N. Patrashev on hydrodynamic forces in the unstabilized motion of highly elongated rotating bodies contained a suggestion for a new method of calculating the non-stationary components of the hydrodynamic viscous force. The calculation of coefficients for such components requires that the velocity profile in the boundary layer and the function which determines the difference in thickness of the layer in the case of stationary and non-stationary flow therein be given. In this case, there is no need for



knowing the relationship between the tangential stresses and the velocity field for the case of non-stationary conditions in the layer. The paper likewise included a statement of the conditions for which the stationary-state hypotheses can be fulfilled in practice in accordance with the determination of viscous hydrodynamic forces.



RESULTS OF THE CONTEST FOR THE PRIZE IMENI ACADEMICIAN  
A.N. KRYLOV

Following is the translation of an unsigned <sup>N<sup>o</sup></sup>  
article in Sudostroveniya (Shipbuilding),  
No 4, 1961, page 83.

On the decision of the contest committee, as approved by the Presidium of the Central Administration of the Scientific-Technical Society of the Shipbuilding Industry, the following prizes were awarded for entries in the annual competition for the Prize imeni Academician A.N. Krylov:

First prize--Doctor of Technical Sciences S.N. Blagoveshchenskiy and Candidate of Technical Sciences V.M. Lavrent'yev--for a complex of scientific projects which formed the basis of the "Stability Norms for Marine and Roadstead Vessels".

These "Norms" which have already gone into effect are well-known to the shipbuilding community. They are of enormous importance to the national economy, in so far as they assure proper safety standards for transport, commercial, and towing vessels, at the same time assuring the maximum exploitation of their technical and economic possibilities. The norms are based on the advanced general concept which takes into account the actual conditions under which vessels may overturn or tilt to a dangerous angle. The fundamental principles underlying the norms are carefully founded on theoretical considerations and statistical data. The norms have served as a basis for working out recommendations put forth by the Soviet delegation to the International Conference on the Protection of Human Life at Sea in 1960.

Second prize--Doctor of Technical Sciences A.A. Kostyukov--for his monograph entitled The Theory of Ship Waves and Wave Resistance.

Along with original results obtained by the author in the study of wave resistance to a convoy of vessels, the development of general methods of calculating wave forces, the determination of resistance of bodies moving near a wall, and the prediction of the relief of waves caused



by the movement of a vessel, the monograph contains an extremely comprehensive critical survey of theoretical writings on the wave resistance of water to the motion of ships in an open and enclosed body of water. The monograph gives an exhaustive treatment of the theory of wave resistance, demonstrating the leading role played by Soviet scientists in the creation and elaboration of its modern methods. The monograph is of great fundamental importance, in so far as it unifies heretofore diversified results and imparts a finished form characteristic of an independent scientific discipline to the theory of wave resistance to vessels.

The methods of calculating wave resistance and wave lifting forces presented in the book are developed with a sufficient degree to make them useful for practical work.

Third prize--Candidate of Technical Sciences A.G. Stepanov--for his work entitled "Some Results of the Statistical Studies of Turbulence and Pitching Motion Aboard the Research Vessel "Mikhail Lomonosov"

This work contains an objective statistical analysis of results obtained in observations carried out by the author in the Atlantic Ocean. It represents a significant new addition to already available information on actual marine turbulence and contains material for obtaining more precise calculations of irregular pitching by the spectral method. This is the first systematic Soviet study of oceanic turbulence executed from such a standpoint as would make it applicable to the specific needs of shipbuilding.